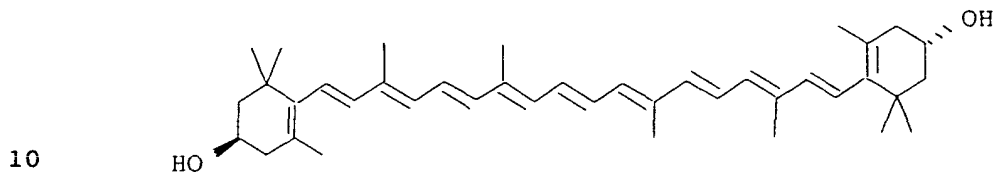


We claim:

1. A process for the preparation of meso-zeaxanthin,

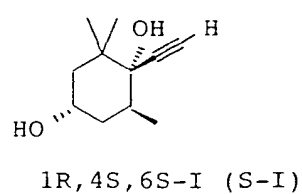
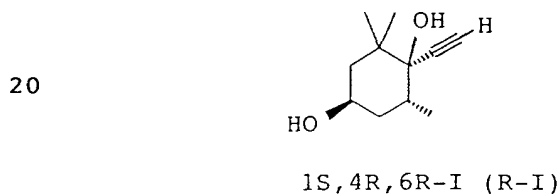
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meso Zeaxanthin

which comprises

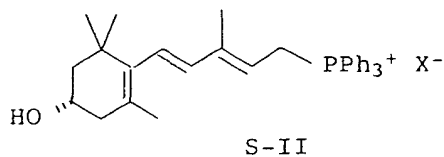
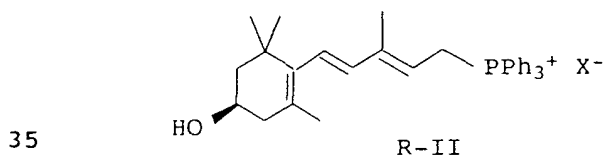
- 15 a) resolving a racemic mixture of the acetylenediols R-I and S-I



- 25 into its antipodes,

- b) converting the separated antipodes R-I and S-I in each case into the C<sub>15</sub>-phosphonium salts R-II and S-II respectively

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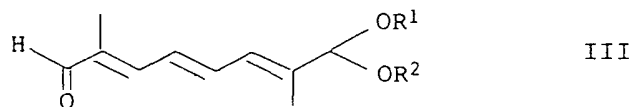
in which Ph is aryl and X is an anion equivalent of an inorganic or organic acid,

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- c) reacting the phosphonium salts R-II or S-II with a C<sub>10</sub>-dial monoacetal of the general formula III,

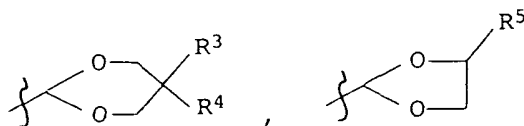
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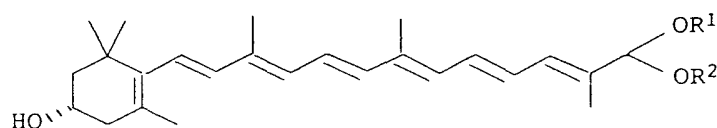
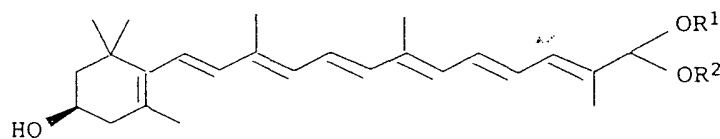


in which the substituents  $R^1$  and  $R^2$  independently of one another are  $C_1$ - $C_8$ -alkyl or, together with the oxygen atoms and the carbon atom to which they are bonded, can form a

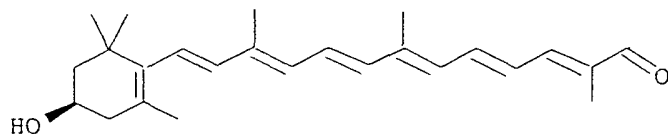
1,3-dioxolane or 1,3-dioxane ring of the following structures



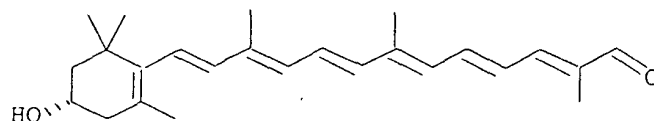
in which  $R^3$  and  $R^4$  and also  $R^5$  in each case independently of one another can be hydrogen or  $C_1$ - $C_4$ -alkyl, in a Wittig reaction to give the  $C_{25}$ -acetals R-IV or S-IV,



d) converting the  $C_{25}$ -acetals R-IV or S-IV into the  $C_{25}$ -aldehydes R-V or S-V



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S-V

e) and reacting the  $C_{25}$ -aldehyde R-V with the  $C_{15}$ -phosphonium salt S-II or the  $C_{25}$ -aldehyde S-V with the  $C_{15}$ -phosphonium salt R-II in a Wittig reaction to give sterically uniform meso-zeaxanthin.

10

2. A process as claimed in claim 1, wherein, in step a), a racemic mixture of the acetylenediols R-I and S-I is converted into a diastereomeric mixture using an optically active auxiliary reagent, the diastereomers are separated and the auxiliary reagent is subsequently removed again.

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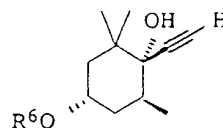
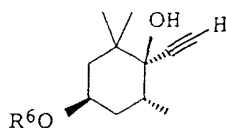
3. A process as claimed in claim 1 or 2, wherein the mixture employed in step a) is a diastereomerically pure racemate of the acetylenediols R-I and S-I.

20

4. A process as claimed in one of claims 1 to 3, wherein, in process step a), the racemate is derivatized selectively on the secondary OH group using an optically active auxiliary reagent, selected from the group consisting of carboxylic acids, carboxylic acid halides, chlorocarboxylic acid esters, sulfonic acids and isocyanates to give a mixture of diastereomeric intermediates of the formulae R-VI and S-VI,

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R-VI

S-VI

in which the substituent  $R^6$  is an optically active urethane radical, carbonate radical, sulfonate radical or an acyl radical.

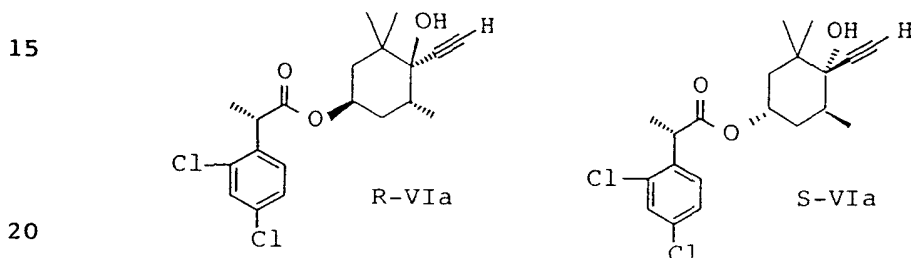
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5. A process as claimed in claim 4, wherein the optically active auxiliary reagents employed are D- or L-lactic acid derivatives.

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## 32

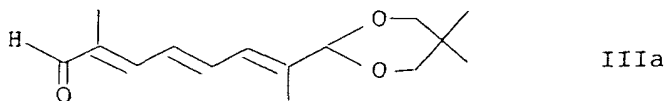
6. A process as claimed in claim 5, wherein the optically active auxiliary reagent employed is D-2,4-dichlorophenoxypropionic acid or D-2,4-dichlorophenoxypropionyl chloride.
- 5 7. A process as claimed in one of claims 1 to 6, wherein, in process step a), the diastereomeric intermediates are separated by crystallization.
8. A process as claimed in claims 6 or 7, wherein
- 10 enantiomerically pure R-I is obtained from the mixture of the diastereomeric D-2,4-dichlorophenoxypropionic acid esters R-VIa and S-VIa



by crystallization of the ester and enantiomerically pure S-I is obtained by crystallization of the hydrolyzed alcohol.

- 25
9. A process as claimed in one of claims 1 to 8, wherein in process step c) the phosphonium salts R-II or S-II are reacted with a C<sub>10</sub>-dialdehyde neopentyl glycol monoacetal of the formula IIIa.

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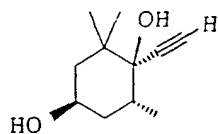
10. A process as claimed in one of claims 1 to 9, wherein the acetal cleavage in process step d) is carried out in aqueous-ethanolic medium with addition of citric acid as acidic catalyst.
- 40
11. A process as claimed in one of claims 1 to 10, wherein the process steps c) to e) are carried out without purification of an intermediate.

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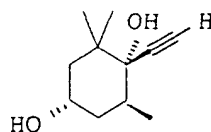
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12. A process for the preparation of optically pure acetylenediols of the formulae R-I and S-I,

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1S,4R,6R-I (R-I)



1R,4S,6S-I (S-I)

10

which comprises converting a racemic mixture of the acetylenediols R-I and S-I into a diastereomer mixture using an optically active auxiliary reagent, separating the diastereomers and then removing the auxiliary reagent again.

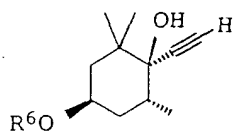
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13. The process as claimed in claim 12, wherein the mixture is a diastereomerically pure racemate.

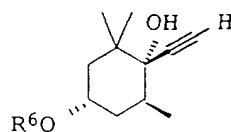
14. A process as claimed in one of claims 12 or 13, wherein the racemate is derivatized selectively on the secondary OH group using an optically active auxiliary reagent selected from the group consisting of carboxylic acids, carboxylic acid halides, chlorocarboxylic acid esters, sulfonic acids and isocyanates to give a mixture of diastereomeric intermediates of the formulae R-VI and S-VI,

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R-VI



S-VI

in which the substituent R<sup>6</sup> is an optically active urethane radical, carbonate radical, sulfonate radical or an acyl radical.

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15. A process as claimed in claim 14, wherein the optically active auxiliary reagent employed is a D- or L-lactic acid derivative.

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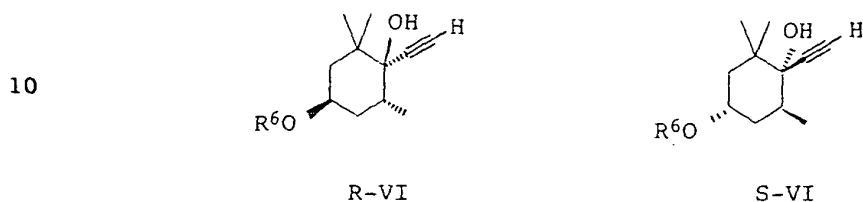
16. A process as claimed in claim 15, wherein the optically active auxiliary reagent employed is D-2,4-dichlorophenoxypropionic acid or D-2,4-dichlorophenoxypropionyl chloride.

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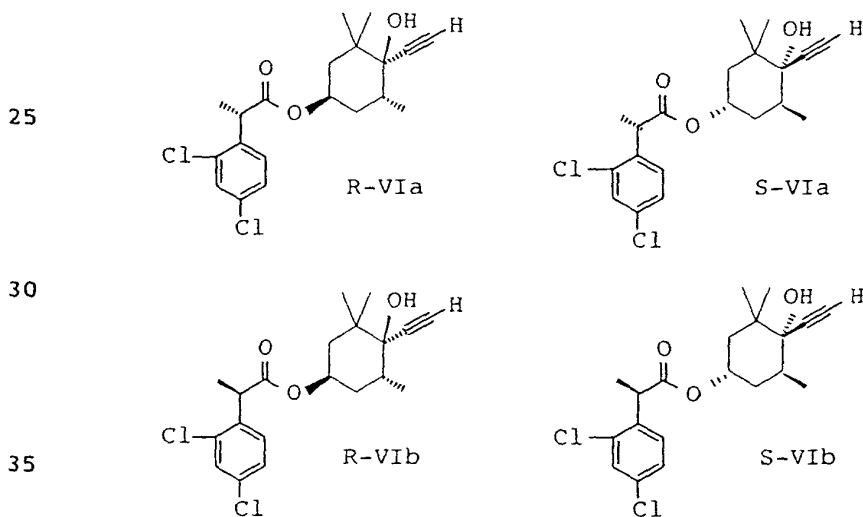
17. A process as claimed in one of claims 12 to 16, wherein the diastereomeric intermediates are separated by crystallization.

5 18. An optically active cyclohexane derivative of the general formula or R-VI or S-VI,

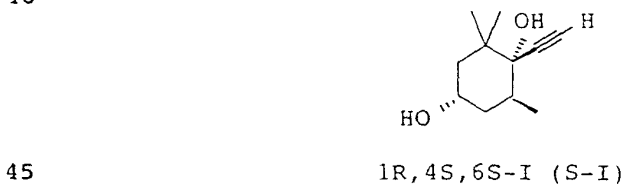


15 in which the substituent R<sup>6</sup> is an optically active urethane radical, carbonate radical, sulfonate radical or an acyl radical.

19. A 2,4-dichlorophenoxypropionic acid ester of the formula  
20 R-VIa or S-VIa, or R-VIb or S-VIb



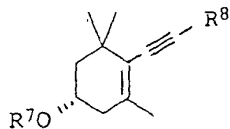
20. An optically active acetylenediol of the formula S-I  
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21. An optically active acetylene compound of the general formula S-VII,

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S-VII

- 10 in which the substituents independently of one another have the following meaning:

R<sup>7</sup> is hydrogen, C<sub>1</sub>-C<sub>12</sub>-acyl or a hydrolytically cleavable acetal or ether protective group;

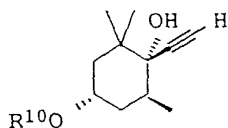
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R<sup>8</sup> is hydrogen or C(CH<sub>3</sub>)OR<sup>9</sup>-CH=CH<sub>2</sub>;

R<sup>9</sup> is lithium or hydrogen.

- 20 22. An optically active cyclohexane derivative of the general formula S-XI,

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S-XI

- 30 in which R<sup>10</sup> is a nonchiral C<sub>1</sub>-C<sub>12</sub>-acyl radical or a hydrolytically cleavable acetal or ether protective group.

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